Effect Of Haemodialysis Session Frequency and Duration on Survival In Australian End-stage Kidney Disease Patients: A Retrospective Cohort Study

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Background

- End-stage kidney disease (ESKD) patients have substantially increased mortality compared to the general population.
- Conventional haemodialysis (HD) of 3 sessions per week of up to 5 hours per session became the mainstay of treatment in the 1970s when US government legislation combined with observational data that thrice weekly dialysis of increasingly shorter durations was at least adequate allowed increasing access to HD.[1]
- Despite improvements in survival in both the general and ESKD populations, mortality rates remain high among dialysis patients in Australia compared to the general population.[2]
- Intensive HD of more frequent and or longer duration treatment has been proposed to improve survival in this population. However, it is not clear whether the improved survival observed in studies is attributed to increased frequency, increased duration, or both.

AIM - This analysis of Australian registry data aimed to assess the independent effects of session frequency and session duration on all-cause mortality in incident ESKD patients receiving HD.

Method

- A retrospective cohort study of HD patients using data from the Australia and New Zealand Dialysis and Transplant (ANZDATA) Registry.
- The cohort included all Australian patients aged ≥18 years who initiated HD of ≥3 sessions/week in Australia from 1 January 2001 to 31 December 2015.
- Indigenous patients, patients receiving <2 sessions/week or patients who received <90 days of HD were excluded.
- Initial dialysis prescription was categorised as 3 sessions/week versus >3 sessions/week, and session durations ≤5 hours/session versus >5 hours/ session.
- Patients were censored at death, transplant, change of dialysis modality or recovery of native kidney function, or 31 December 2015, whichever came first.
- The main outcome was patient mortality.
- Survival analysis was performed using Cox regression analysis, with multivariable analysis controlling for available covariates.
- The final regression model included an interaction term between session frequency and session length.

Table 2: Summary of Main Outcomes

	Total	3 sessions/week	>3 sessions/ week	*P*	≤5 hours/ session	>5 hours/ session	*P*
Number (%)	16944 (100)	16187 (95.5)	757 (4.5)		16426 (96.9)	518 (3.1)	
Mortality, deaths/100 person-years	15.58	15.89	8.77	<0.001	15.95	5.08	<0.001
Median Survival, years (CI)	4.62 (4.50 - 4.72)	4.53 (4.42 - 4.65)	7.00 (6.47 - 8.73)		4.5 (1.40 - 4.63)	10.5 (7.82 - indef.)	
Adjusted Hazard of death	**NA**	**Ref.**	**0.97 (0.84 - 1.13)**	**0.78**	**Ref.**	**0.57 (0.44 - 0.74)**	**<0.001**

Results

- In total, 16,944 patients were included in survival analyses with a combined follow up time of 54478.2 person-years.
- Cohort characteristics and outcomes are summarised in Table 1 and Table 2.
- Adjusted Survival Curves shown in Figure 1 and Figure 2.

Table 1: Summary of Cohort Characteristics

Characteristic	Total n = 16944	3 sessions/ week n = 16187	>3 sessions/ week n = 757	*P*	≤5 hours/ session n = 16426	>5 hours/ session n = 518	*P*
Male, n (Pct.)	10989 (64.9)	10426 (64.4)	563 (74.4)	<0.001	10564 (64.3)	425 (82.0)	<0.001
Age, mean (SD)	62.73 (14.88)	63.16 (14.75)	53.53 (14.71)	<0.001	63.10 (14.79)	50.83 (12.83)	<0.001
BMI kg/m2, mean (SD)	28.50 (7.04)	28.43 (7.02)	30.04 (7.39)	<0.001	28.39 (6.97)	31.94 (8.26)	<0.001
Smoking history (current/ former), n (Pct.)	9357 (55.2)	8970 (55.4)	387 (51.1)	0.022	9083 (55.3)	274 (52.9)	0.3
Primary disease, n (Pct.)							
Glomerulonephropathies	3827 (22.6)	3601 (22.2)	226 (29.9)		3660 (22.3)	167 (32.2)	
Analgesic	382 (2.3)	373 (2.3)	9 (1.2)		381 (2.3)	1 (0.2)	
HTN or Renovascular	2674 (15.8)	2581 (15.9)	93 (12.3)		2620 (16.0)	54 (10.4)	
Polycystic	1187 (7.0)	1065 (6.6)	122 (16.1)		1106 (6.7)	81 (15.6)	
Diabetes	5258 (31.0)	5092 (31.5)	166 (21.9)		5126 (31.2)	132 (25.5)	
Reflux	419 (2.5)	382 (2.4)	37 (4.9)		399 (2.4)	20 (3.9)	
Uncertain	995 (5.9)	962 (5.9)	33 (4.4)		979 (6.0)	16 (3.1)	
Other	2202 (13.0)	2131 (13.2)	71 (9.4)	<0.001	2155 (13.1)	47 (9.1)	<0.001
Comorbidities, n (Pct.)							
Chronic Lung Disease	2891 (17.1)	2808 (17.3)	83 (11.0)	<0.001	2836 (17.3)	55 (10.6)	<0.001
Ischemic Heart Disease	7299 (43.1)	7088 (43.8)	211 (27.9)	<0.001	7171 (43.7)	128 (24.7)	<0.001
Peripheral Vascular Disease	4556 (26.9)	4424 (27.3)	132 (17.4)	<0.001	4477 (27.3)	79 (15.3)	<0.001
Cerebral Vascular Disease	2652 (15.7)	2597 (16.0)	55 (7.3)	<0.001	2617 (15.9)	35 (6.8)	<0.001
Diabetes	7298 (43.1)	7057 (43.6)	241 (31.8)	<0.001	7114 (43.3)	184 (35.5)	<0.001
Ever Diagnosed Cancer	4747 (28.0)	4570 (28.2)	177 (23.4)	0.004	4636 (28.2)	111 (21.4)	0.001
Hours/session, median (IQR)	4 (4-5)	4 (4-4.5)	5 (4-6)		4 (4-4.5)	6 (6-8)	
Sessions/week, median (IQR)	3 (3-3)	3 (3-3)	4 (3.5-4)		3 (3-3)	3 (3-3.5)	
Location, n (Pct)							
In-centre, n (Pct.)	16851 (99.5)	16121 (99.6)	730 (96.4)		16344 (99.5)	507 (97.9)	
Home, n (Pct.)	93 (0.5)	66 (0.4)	27 (3.6)	<0.001	82 (0.5)	11 (2.1)	<0.001

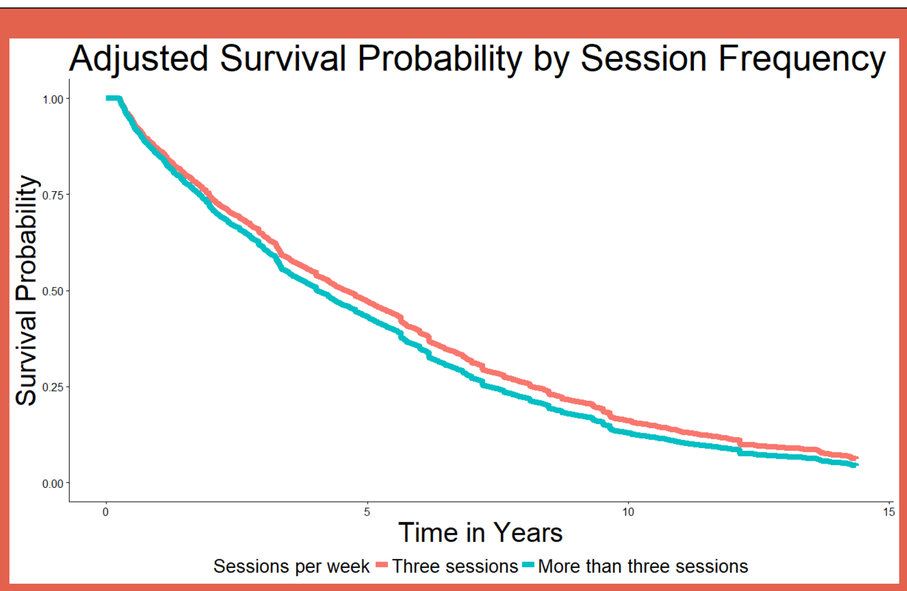

Figure 1: Adjusted survival curve showing comparable survival of frequent (>3 sessions/week) and conventional 3 sessions/week HD.

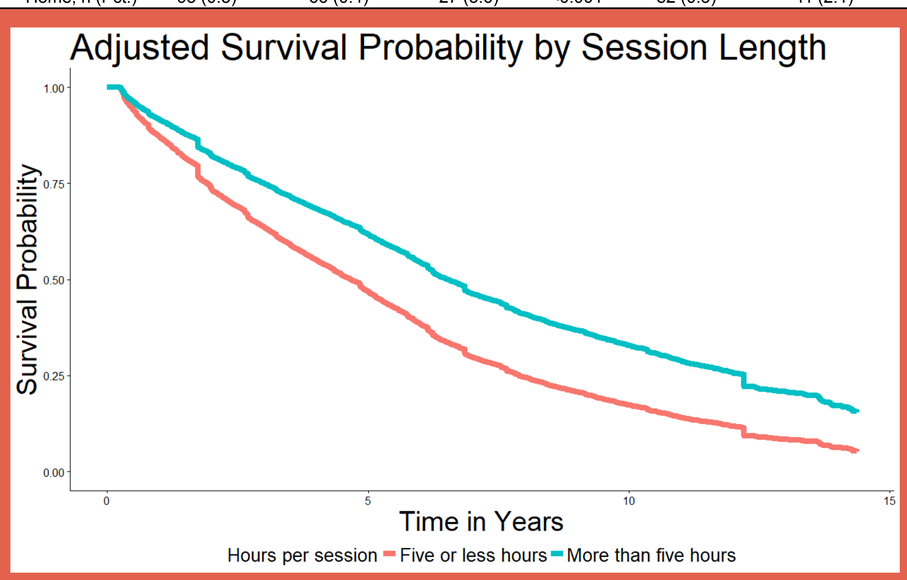

Figure 2: Adjusted survival curve showing advantage of longer session length (>5 hours/ session) compared to conventional duration of up to 5 hours/session.

Conclusion

- Results indicate that initial longer session durations >5 hours, but not more frequent HD, are associated with improved survival on dialysis in non-Indigenous Australian adult ESKD patients initiating HD.
- This suggests that it is the increased duration of intensive dialysis rather than the increased frequency that has the greatest effect on survival in these patients.
- Further analyses are required to investigate the potential causal mechanisms, as well as the optimal HD prescription that achieves greatest patient tolerability and outcomes for dialysis patients, not only for survival but quality of life.

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References

1 Lacson E, Jr., Brunelli SM. Hemodialysis treatment time: a fresh perspective. *Clin J Am Soc Nephrol*. 2011; **6**: 2522-30.
2 Australia and New Zealand Dialysis and Transplant (ANZDATA) Registry. Chapter 3: Mortality in end stage kidney disease. Adelaide, Australia: Australia and New Zealand Dialysis and Transplant Registry 2017.

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ANZ DATA
AUSTRALIA & NEW ZEALAND DIALYSIS & TRANSPLANT REGISTRY